Appendix to item 23.6

Report to the 32nd General Assembly
FIG Working Week in Eilat, Israel 2009

FIG Commission 6 – Engineering Surveying

Report of Activities 2008-2009

1. General

The field of interest of Commission 6 are traditional the acquisition, processing and management of topometric data and all related information throughout the life cycle of a project (at construction site), quality control and validation for civil engineering constructions and manufacturing of large objects, modern concepts for setting-out and machine guidance, deformation monitoring, analysis and interpretation, measurement of dynamic loaded structures (general), prediction of deformation and movements in engineering projects, mines and areas of geological hazard, automatic measuring systems, construction and industry and multi-sensor measuring systems, terrestrial laser systems, their usage in architecture, civil engineering and industry and standards related to the construction and deformation measurement. The main topics of the Commission 6 are covered in the former period by five Working Groups, which structure was completed by the sixth Working Group oriented for terrestrial laser scanning.

2. Working Groups

WG6.1 – Deformation Measurement and Analysis

Chair: Adam Chrzanowski (Canada); Vice-chair: Cecilia Whitaker (USA)

WG activities are focused on the automation of monitoring surveys, enhancement of geometrical modelling of deformations from integrated deformation surveys, physical interpretation of deformations including numerical modelling and prediction of deformations and back analysis. A main objective of this WG is to propose or improve techniques to analyze historical geodetic data in comparison with modern ones, mostly GPS-based. This is expected to permit:

- to extend the geodetic information on crustal deformation in larger time and space scales; especially to compare data collected after a certain event (for instance an earthquake) with those collected before it in areas not covered yet by extensive GPS networks.
- to examine whether the pattern of crustal deformation derived from longer term data (tens to hundreds of years) differs from the short-term one, derived mainly from modern, usually satellite data. This investigation is not limited to tectonic and seismic effects (especially the local earthquake cycle) but extends also to volcanic effects and to rather surficial effects (for instance synsedimentary faulting in young deposits, sediment consolidation, etc).

The results obtained were presented in several meetings in Greece, Germany, France, Italy, Turkey. In the Perugia IUGG 2007 Congress and in particular in an IAG Symposium there has been an important participation and there was much interest, especially from Japanese people.

WG6.2 – Engineering Surveys for Industry and Research
Chair: Thomas Wunderlich (Germany); Vice-chair: Peter Kyrinovic (Slovakia)

The main goal of WG activity is to provide the specialists involved in that kind of missions with the latest state of the art concerning the use of adapted survey techniques in industry & engineering, multidisciplinary collaboration between survey engineers, civil engineers, structural & mechanical engineers, R&D scientists - for a better approach of complex engineering survey problems, specific algorithms, instrumentation, equipment and techniques in engineering surveys, high precision measurements and special techniques for the large scale metrology of big equipment or structures, integration of survey & alignment sensors with actuators and/or tools for on-line monitoring and control of a given process (dynamic systems).

WG6.3 – Engineering Survey Data Bases and Facility Management
Chair: Lothar Gründig (Germany); Vice-chair: Vladimir Seredovich (Russia)

WG activity is focusing on the role of the surveying engineer as the responsible manager of spatially referenced information, support for the co-ordination of the activities of other disciplines, building concepts of data models for the mapping of relevant 4D or 5D project data, covering 3D geometry, time, and descriptive attributes, exchange, provision and presentation of facility management data in computer networks, data integration for this subject, taking into accounts the presence of redundant data and different sources of information and automation and combination of feasible data acquisition techniques.

WG6.4 – Engineering Surveys for Construction Works and Structural Engineering
Chair: Gethin Wyn Roberts (UK); Vice-chair: Joël Van Cranenbroek (Belgium)

The WG are promoting the use of adapted survey techniques in industry & engineering, promoting a multidisciplinary collaboration between survey engineers, civil engineers, structural & mechanical engineers, promoting the understanding of fibre optic sensors, e.g. interferometric sensors, study the use of embedded sensor arrays and the role of advanced surveying techniques for structural monitoring, creating an awareness of surveyors through a task force 'Fibre optic sensors' of the rapidly emerging technology of fibre optic sensors as "non-geodetic" sensors to measure deformations (strain) and temperatures in civil engineering structures.

WG6.5 – Terrestrial Laser Scanners – joint WG with FIG C5
Chair: Maria Tsakiri (Greece); Vice-chair: Rudolf Staiger (Germany);

WG is promoting the usage of laser scanning for geometric documentation in a variety of environments, particularly high risk and environments which benefit of remote measurements (e.g. structures, slopes, underground surveys, structural deformations of cultural heritage monuments), investigate existing and developing terrestrial laser scanner instrumentation for engineering applications, evaluate and compare algorithms for processing terrestrial laser scanner data (e.g. registration, surface modelling, etc.), investigate and document metrological and quality control issues for laser scanning measurements, investigate the integration of laser scanning measurements with other measuring techniques, such as conventional geodetic systems and photogrammetric techniques.

The special and actual topics in focus of Commission 6 were covered by six Study Groups. Their activities were oriented to:

- **SG 1** ***'Continuum Mechanics as a Support for Deformation Monitoring, Analysis and Interpretation'***, chaired by Anna Szostak-Chrzanowski (Canada)
- ***SG 2 'Optimal Use of Interferometric Synthetic Aperture Radar (InSAR)'***, chaired by Linlin Ge (Australia)
- ***SG 3 'Crustal Deformation'***, chaired by Stathis Stiros (Greece)
- ***SG 4 'Monitoring and Analysis of Cyclic Deformations and Structural Vibrations'***, chaired by Gethin Wyn Roberts (UK)
- ***SG 5 'Fibre Optic Sensors'***, chaired by Helmut Woshitz (Austria)
- ***SG 6 'Terrestrial-Based RF Positioning Technologies'***, chaired by Joel Barns (Australia)

3. Events in 2008

During the 2008 were 6 conferences and seminars planned. The first, in the series events covered by the Commission 6 was the **13th International Symposium on Deformation Measurements** in Lisbon (Portugal), which was held in May 12-15, 2008 and organised by the WG6.1 and SG1, SG2, SG3 and SG6 together with IAG C4, Sub-commission 4.2, Applications of Geodesy in Engineering (4th IAG Symposium on Geodesy for Geotechnical and Structural Engineering). The theme of the symposium **"***Measuring the Changes***"** reflects the importance, and demand, for fully automated, continuous, and reliable deformation monitoring in the civil engineering, mining, and energy sectors. In addition there is a strong trend to incorporate deformation systems into new structures from the very beginning, driven by concerns for whole-of-life structural health monitoring. Automation, multi-sensor integration, continuous data collection, integrated analysis and physical interpretation, and enhanced accuracy and reliability are the key developments in new monitoring systems. The annual meeting of SG5 was held in Lisbon during the conference. More at: http://www.fig.net/news/news_2008/lisbon_may_2008.htm.

In Novosibirsk (Russia) was held the 4th International Exhibition and Scientific Congress **GEO-SIBERIA 2008**, which was parallel devoted to the 25th Anniversary of the Siberian State Geodetic Academy. This largest surveying event in Russia was co-sponsored by FIG C6, namely by their WG6.4.

The **1st International Conference on Machine Control & Guidance** prepared by ETH Zurich (Switzerland) was held in June 24-26, 2008, with participation of the WG6.2 and WG6.5 members. During the conference, which attend over 130 participants from different backgrounds and made the conference to successful, the following sessions were held:

- 3D-Construction Applications I (Excavator), II & III
- Kinematic Measurement and Sensor Technology (Local and GNSS Systems)
- Agriculture Applications
- Data Processing an Data Acquisition
- Control Process and Control Algorithm

Conference proceedings can be ordered at http://www.geometh.ethz.ch/ or papers and presentation can be downloaded at http://www.mcg.ethz.ch/index

Commission 6 participated at the **FIG Working Week 2008** in Stockholm with 6 technical sessions devoted to the engineering survey topics and the commission annual meeting build

space for presentation of the progress made by the commission WG s and study groups. Traditional annual meeting of the commission was held during the WW, during this were discussed actual topics of deformation monitoring, analysis and interpretation using continuum mechanics, monitoring and analysis of crustal deformations, optimal use of InSAR technology, terrestrial-based RF positioning technologies, methods and equipment of terrestrial laser scanning for engineering surveying procedures, analysis of cyclic deformations and structural vibrations, monitoring of dynamic loaded structures, application of automatic measuring systems for machine guidance, setting-out and measurement of deformations, multidisciplinary expertise and co-operation, which lead to integrated survey methods and systems, co-operation with other professional organisations (IAG, ISM, ISPRS, etc.). All papers were included to the FIG library - http://www.fig.net/srl/

The **4th International Conference on Engineering Surveying – INGEO** prepared by the WG6.2 members was held traditional in Bratislava (Slovakia) in October 22-23, 2008. The conference had in focus the new methods and tools to support the effective data collection were developed in the last ten years worldwide. The questions of effective application and usage of new technology, their reliability and operability were discussed actually during the conference. The conference discussion was focused on present-day questions of laser scanning, usage of laser scanners in industry surrounding, for measurement of dynamic deformations, data acquisition and processing, too.
More at: http://web.svf.stuba.sk/kat/GDE/Ingeo2008/Ingeo.html

The traditional seminar about **Terrestrial Laser Scanning** was held in November 6-7, 2008 in Fulda (Germany). This seminar shows the stage of development of the sensors, processing as well as application. Furthermore a view of future developments was given. This event is organised by together with the DVW and FIG C5 with participation of FIG C6 members. http://www.tls2008.inmetris3d.de

4. Future events

Commission 6 participates to the FIG Working Week in Eilat, Israel by technical sessions devoted to the engineering survey topics and by organising Commission 6 annual meeting. These build space for presentation of the progress made by the Commission WGs and study groups. Many of the prepared and presented papers underline the motto of the Working Week - *Surveyors Key Role in Accelerated Development***.** Some of Technical Sessions are organised together with ISPRS, ISM and IAG, also in co-operation with other FIG Commissions. http://www.fig.net/fig2009/techprog.htm

For 2009 are many conferences and seminars planed:

- In Novosibirsk (Russia) will take place the **5th International Exhibition and Scientific Congress GEO-SIBERIA 2009**, which is co-sponsored by FIG C6, namely by WG6.4. http://www.geosiberia.sibfair.ru/eng

- The **9th Conference on Optical 3-D Measurement Techniques** is organised in Vienna, July 1-3, 2009. This event is organised in co-operation with FIG Commission 5 and 6, ISPRS Commission V and IAG Sub-commission 4.2. Web site: http://info.tuwien.ac.at/ingeo/optical3d/

- The **10th South East Asian Survey Congress (SEASC '09)** hosted by Bakosurtanal in August 4-7, 2009, will arrange the space for discussion in all field of interest the FIG, also for the Commission 6 and the topic Engineering Surveying. Web site: www.seasc2009.org

- The traditional **Seminar on Terrestrial Laser Scanning** in Fulda, is planed at the end of 2009. This will be organised by Commissions 5 and 6 of the FIG together with the DVW.

- The **6th International Bridge Design, Construction and Maintenance Conference** co-sponsored by FIG Commission 6, planned for November 10-12, 2009 in New Delhi, India, has been postponed by the organisers. The purpose of this conference was to provide a forum for bridge practitioners and researchers to share their experiences and understanding, to highlight notable successes and to ensure that progress is maintained. The programme was designed to be as wide-ranging (including bridge monitoring) as possible so that all might benefit. More information you find at: www.ice-bdcm.com

Prof. Alojz Kopáčik
Chair of FIG Commission 6

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